PLANT ITEM MATERIAL SELECTION DATA SHEET

RLD-BRKPT-00007 & RLD-BRKPT-00009 (HLW)
Acidic Wash Transfer Breakpot

R10342879

- Design Temperature (°F) (max/min): 368/40
- Design Pressure (psig) (internal/external): 15/FV
- Location: incell

Contents of this document are Dangerous Waste Permit affecting

Operating conditions are as stated on sheet 5 and 6

ISSUED BY RPP-WTP PDC
INIT DATE

Operating Modes Considered:

- Normal operations

Materials Considered:

Material (UNS No.)	Relative Cost	Acceptable Material	Unacceptable Material
Carbon Steel	0.23		X
304L (S30403)	1.00		X
316L (S31603)	1.18	X	
6% Mo (N08367/N08926)	7.64	X	
Alloy 22 (N06022)	11.4	X	
Ti-2 (R50400)	10.1		X

Recommended Material: 316 (max 0.030% C; dual certified)

Recommended Corrosion Allowance: 0.04 inch (includes 0.00 inch erosion allowance)

Process & Operations Limitations:

- Develop procedure for thoroughly flushing with water.

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8/5/04
EXPIRES: 12/07/05

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This bound document contains a total of 6 sheets.

REV	DATE	REASON FOR REVISION	PREPARER	CHECKER	APPROVER
0	7/15/04	Issued for Permitting Use			

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Corrosion Considerations:

Breakpots are normally empty and at ambient temperature. Steam is used for transfer and breakpots could see steam temperatures but such conditions will be of short duration. Breakpots will routinely transfer effluent from RLD-VSL-00007 and RLD-VSL-00008.

a General Corrosion
Wilding and Paige (1976) have shown that in 5% nitric acid with 1000 ppm fluoride at 290°F, the corrosion rate of 304L can be kept as low as 5 mpy by the use of Al^{+++}. Additionally, Sedriks (1996) has noted with 10% (≈2N) nitric acid and 3,000 ppm fluoride at 158°F, the corrosion rate of 304L is over 4,000 mpy. Extrapolating acid concentration, fluoride concentration, and temperature, suggests the corrosion rate for 304L and 316L would be less than about 1 mpy. The presence of Al^{+++} is expected to reduce the corrosion rate to near zero. It is probable that 304L or 316L would be satisfactory at the listed conditions. The less control of the acid conditions, the more consideration that will have to be given to more corrosion resistant alloys.

Conclusion:
304L and 316L are expected to be sufficiently resistant to the waste solution with a probable general corrosion rate of less than 1 mpy. The uniform corrosion rate of higher alloys will be smaller.

b Pitting Corrosion
Chloride is known to cause pitting in acid and neutral solutions. Normally the vessel is to be at ambient temperatures, with possible brief excursions to steam temperatures at transfer, at a pH ranging from 2 to 14, based on upstream vessels RLD-VSL-00007 and RLD-VSL-00008. Extrapolating from Wilding & Paige data (1976), it appears that 304L would not pit due to the presence of the excess nitrate. Berhardsson et al (1981) have similar conclusions based solely on concentrations. However, 316L will provide added protection against chloride concentrate during operation and is recommended.

Conclusion:
Based on the stated operating conditions, 316L is expected to be satisfactory.

c End Grain Corrosion
End grain corrosion occurs in hot concentrated acid conditions.

Conclusion:
Not believed likely in this system.

d Stress Corrosion Cracking
The exact amount of chloride required to cause stress corrosion cracking is unknown. In part this is because the amount varies with temperature, metal sensitization, the environment, and also because chloride tends to concentrate under heat transfer conditions, by evaporation, and electrochemically during a corrosion process. Hence, even as little as 10 ppm can lead to cracking under some conditions. Generally, as seen in Sedriks (1996) and Davis (1987), stress corrosion cracking does not usually occur below about 140°F for sensitized alloys. With the proposed normal conditions, 316L is recommended.

Conclusion:
For the stated operating environment, 316L is acceptable.

e Crevice Corrosion
Assuming no adherent deposits remain, and the stated operating conditions, 316L is acceptable. Also see Pitting.

Conclusion:
A minimum of 316L is recommended.

f Corrosion at Welds
Weld corrosion is not considered a problem in the proposed environment.

Conclusion:
Weld corrosion is not considered a problem for this system.

g Microbiologically Induced Corrosion (MIC)
The proposed operating conditions are not conducive to microbial growth.

Conclusion:
MIC is not considered a problem.

h Fatigue/Corrosion Fatigue
Corrosion fatigue is a not expected to be a problem.

Conclusions
Not expected to be a concern.

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i Vapor Phase Corrosion
Vapor phase corrosion is not expected to be a concern. Further, the presence of wash rings indicates deposits can be prevented.

Conclusion:
Not expected to be a concern

j Erosion
Velocities within the vessel are expected to be low.

Conclusion:
Not a concern.

k Galling of Moving Surfaces
Not applicable.

Conclusion:
Not applicable.

l Fretting/Wear
No contacting surfaces expected.

Conclusion:
Not applicable.

m Galvanic Corrosion
No dissimilar metals are present.

Conclusion:
Not a concern.

n Cavitation
None expected.

Conclusion:
Not believed to be of concern.

o Creep
The temperatures are too low to be a concern.

Conclusion:
Not applicable.

p Inadvertent Nitric Acid Addition
Higher chloride contents and higher temperatures usually require higher alloy materials. Nitrate ions inhibit the pitting and crevice corrosion of stainless alloys. Furthermore, nitric acid passivates these alloys; therefore, lower pH values brought about by increases in the nitric acid content of process fluid will not cause higher corrosion rates for these alloys. The upset condition that was most likely to occur is lowering of the pH of the vessel content by inadvertent addition of 0.5 M nitric acid. Lowering of pH may make a chloride-containing solution more likely to cause pitting of stainless alloys. Increasing the nitric acid content of the process fluid adds more of the pitting-inhibiting nitrate ion to the process fluid. In addition, adding the nitric acid solution to the stream will dilute the chloride content of the process fluid.

Conclusion:
The recommended materials will be able to withstand a plausible inadvertent addition of 0.5 M nitric acid.

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References:

1. Berhardsson, S, R Mellstrom, and J Oredsson, 1981, *Properties of Two Highly corrosion Resistant Duplex Stainless Steels*, Paper 124, presented at Corrosion 81, NACE International, Houston, TX 77218
2. Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
3. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158
4. Wilding, MW and BE Paige, 1976, *Survey on Corrosion of Metals and Alloys in Solutions Containing Nitric Acid*, ICP-1107, Idaho National Engineering Laboratory, Idaho Falls, ID

Bibliography:

1. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073
2. Hamner, NE, 1981, *Corrosion Data Survey*, Metals Section, 5th Ed, NACE International, Houston, TX 77218
3. Jones, RH (Ed.), 1992, *Stress-Corrosion Cracking*, ASM International, Metals Park, OH 44073
4. Koch, GH, 1995, *Localized Corrosion in Halides Other Than Chlorides*, MTI Pub No. 41, Materials Technology Institute of the Chemical Process Industries, Inc, St Louis, MO 63141
5. Uhlig, HH, 1948, *Corrosion Handbook*, John Wiley & Sons, New York, NY 10158
6. Van Delinder, LS (Ed), 1984, *Corrosion Basics*, NACE International, Houston, TX 77084

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OPERATING CONDITIONS

PROCESS CORROSION DATA SHEET

Component(s) (Name/ID #) Acidic waste transfer breakpot
(RLD-BRKPT-00007, RLD-BRKPT-00009)

Facility HLW

In Black Cell? Yes

Chemicals	Unit[1]	Contract Maximum		Non-Routine		Notes
		Leach	No leach	Leach	No Leach	
Aluminum	g/l	4.33E-02	6.84E-02			
Chloride	g/l	1.49E-01	1.82E-01			
Fluoride	g/l	9.19E-02	1.22E-01			
Iron	g/l	4.19E-01	3.23E-01			
Nitrate	g/l	2.54E+01	2.57E+01			
Nitrite	g/l					
Phosphate	g/l	2.28E-03	4.77E-03			
Sulfate	g/l					
Mercury	g/l	5.15E-01	7.66E-01			
Carbonate	g/l					
Undissolved solids	wt %	0.35%	0.37%			
Other (Pb)	g/l	1.47E-02	1.06E-02			
Other	g/l					
pH	N/A					
Temperature	°F					Note 2

List of Organic Species:

Notes:
1. Concentrations less than 1x 10^{-4} g/l do not need to be reported; list values to two significant digits max.
2. Streams entering breakpots use steam for transfer for short duration, but breakpots are normally empty.

Assumptions

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5.6.3 Acidic Waste Transfer Breakpot (RLD-BRKPT-00007, RDL-BRKPT-00009)

Routine Operations

Receives effluent from RLD-VSL-00007 and RLD-VSL-00008, and transfers to PWD-VSL-00043.

Non-Routine Operations that Could Affect Corrosion/Erosion

None identified.